

Quiz 1, Sec 3



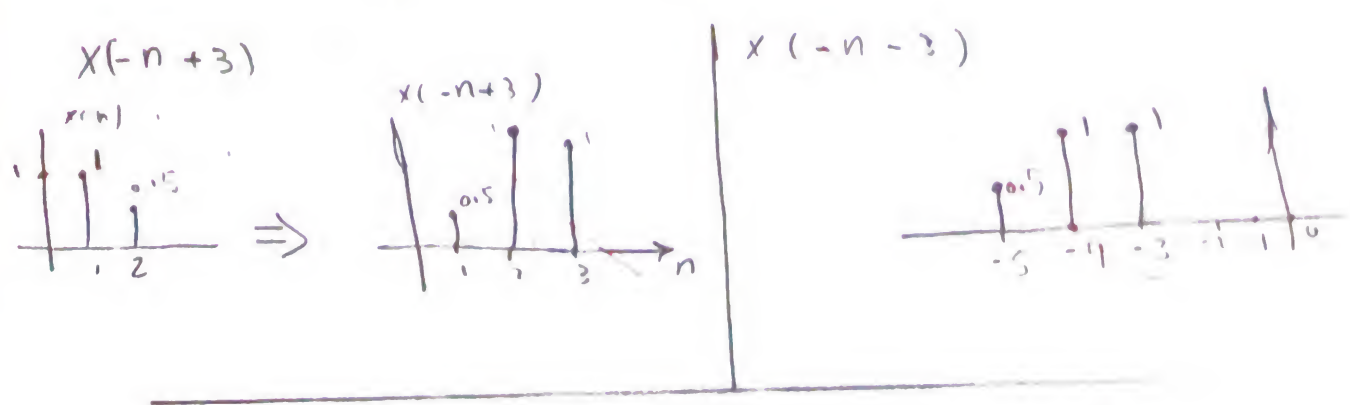
① $x(n) = u(n) - u(n-2) + 0.5 \delta(n-2)$, express $x(n)$ in the sequence form and find

$x(-n+3)$, $x(-n-3)$

② compute convolution of $x(n) = \begin{cases} a^n & -1 \leq n \leq 2 \\ 0 & \text{otherwise} \end{cases}$ $a=2$
 $h(n) = 3\delta(n) - \delta(n-1) + 2\delta(n-2)$

③ find z-transform of
 $x(n) = (-1)^n \cos(\omega n) + 3\delta(n-2) + e^n$

① $x(n) = \{1, 1, 0.5\}$
 (with an arrow pointing to the first '1' at n=0)



② $x(n) = \{2^{-1}, 1, 2, 4\}$, $h(n) = \{3, -1, 2\}$
 (with arrows pointing to the first elements of each sequence)

$$n_{\text{start}} = n_{x_{\text{st}}} + n_{h_{\text{st}}} = -1 + 0 = -1$$

$$n_{\text{end}} = n_{x_{\text{en}}} + n_{h_{\text{en}}} = 2 + 2 = 4$$

at $n = -1$

$$\begin{aligned} x(n) * h(n) &= \sum_{k=-1}^2 x(k) h(n-k) \\ &= x(-1)h(0) + x(0)h(-1) + x(1)h(-2) \\ &\quad + x(2)h(-3) = \frac{1}{2} * 3 = 1.5 \end{aligned}$$

at $n=0 \Rightarrow$

$$\begin{aligned}x(n) * h(n) &= \sum_{k=-1}^2 x(k) h(n-k) \\&= x(-1) h(1) + x(0) h(0) + x(1) h(-1) \\&\quad + x(2) h(-2) \\&= \frac{1}{2} \times 1 + 1 \times 3 = 2.5\end{aligned}$$

at $n=1$

$$\begin{aligned}x(n) * h(n) &= \sum_{k=-1}^2 x(k) h(n-k) \\&= x(-1) h(2) + x(0) h(1) + x(1) h(0) \\&= \frac{1}{2} \times 2 + 1 \times 1 + 2 \times 3 = 6\end{aligned}$$

at $n=2$

$$\begin{aligned}x(n) * h(n) &= \sum_{k=-1}^2 x(k) h(n-k) \\&= x(-1) h(3) + x(0) h(2) + x(1) h(1) \\&\quad + x(2) h(0) \\&= 1 \times 2 + 2 \times 1 + 4 \times 3 = 12\end{aligned}$$

at $n=3$

$$\begin{aligned}x(n) * h(n) &= \sum_{k=-1}^2 x(k) h(n-k) \\&= x(-1) h(4) + x(0) h(3) + x(1) h(2) \\&\quad + x(2) h(1) = 2 \times 2 + 4 \times 1 = 0\end{aligned}$$

at $n=4$

$$\begin{aligned}x(n) * h(n) &= \sum_{k=-1}^2 x(k) h(n-k) \\&= x(-1) h(5) + \dots + x(2) h(2) \\&= 4 \times 2 = 8\end{aligned}$$

$$\therefore x(n) * h(n) = \{1.5, 2.5, 6, 12, 0, 8\}$$

\Rightarrow turn over

cont. Quiz 1

sec 3

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$$ZT [(-1)^n \cos(\omega n) + 3\delta(n-2) + e^n]$$

$$X(z) = ZT [(-1)^n \cos(\omega n)] + ZT [3\delta(n-2)] + ZT [e^n]$$

$$= \frac{z(z - \cos \omega)}{z^2 - 2z \cos \omega + 1} \bigg|_{z = \frac{z}{-1}} + 3 \times z^{-2} + \frac{z}{z - e}$$

$$= \frac{-z(-z - \cos \omega)}{(-z)^2 + 2z \cos \omega + 1} + 3z^{-2} + \frac{z}{z - e}$$

$$= \frac{z(z + \cos \omega)}{z^2 + 2z \cos \omega + 1} + 3z^{-2} + \frac{z}{z - e}$$